

Kentucky Landscape Snapshot

Kentucky Land Cover Data Set 2001 (KLC01) Map Review Document

Prepared for:

Kentucky Commonwealth Office of Technology (COT)

02/09/05



Prepared by:
Mike Palmer
455 E. Eisenhower Parkway, Suite 70
Ann Arbor
MI 48108



Kentucky Landscape Snapshot



CONFIDENTIAL NOTICE

The information contained in this report is proprietary and confidential. This report and its contents may not be used, duplicated, communicated, or disclosed, in whole or in part without the express written permission of the Division of Geographic Information (DGI).

Kentucky Land Cover Data Set 2001 (KLCD01) Map Review Document

Table of Contents

1	INTRODUCTION.....	5
1.1	DOCUMENT LAYOUT	5
2	REVIEW OF KLS LANDCOVER LEVEL III MAP.....	6
2.1	KLCD01 CLASSIFICATION SCHEME	6
3	QA/QC: THE BY - AREA REVIEW PROCESS	8
3.1	MINIMUM MAPPING UNIT AND SCALE OF MAP	8
3.2	RECORDING ASSESSMENT.....	8
3.3	PROVISION OF DATA TO COT.....	10
4	SCHEDULE	11
5	APPENDIX A: DECISION RULES FOR LEVEL II CLASSIFICATION	12

Table of Figures

FIGURE 1 KLCD 2001 LAND COVER DATA SET (1:24000:700602, 1568941 ACEA* NAD83) 10

FIGURE 2 NAIP LEAF ON 1 METER IMAGERY (1:24000:700602, 1568941 ACEA* NAD83) .. 10

* ALBERS CONICAL EQUAL AREA

Introduction

This document is designed to help reviewers of the Kentucky Landscape Snapshot land cover map. In order to ensure a high quality product we need a review of the 2001 Kentucky Land Cover Data Set (KLCD01) by people familiar with the land cover of the Commonwealth, and who eventually will be part of the group of users of the map. It is important to have the map reviewed by people who are familiar with the land cover types being mapped since this will help identify areas where systematic misclassification has occurred and these confusions can be rectified before the map is published.

Since volunteer reviewers will likely become part of a group of users of the products, it is in each person's interest to spend significant time reviewing the data product to ensure its accuracy focusing on the classes and geographic areas of interest to the reviewer. In order for the comments of the reviewers to be of most use we need the comments to come back in a systematic format. We describe in this document the procedure we need reviewers to use for feedback. Comments that are not received in this format will be more difficult to incorporate into the final map.

1.1 Document layout

The document is divided into five sections

- Section 1 is an introduction
- Section 2 explains the classification system. It is important that each reviewer understand the classification system because this is how the landscape was mapped, which may not correspond to the reviewer's specific idea of definition of the cover type, purely by its name. Also Appendix A (see below) gives the decision rules for the classification scheme and should be read prior to map review.
- Section 3 outlines the approach that we would like each reviewer to take while that reviewer conducts his/her review of the map, including the format of the output.
- Section 4 lays out the proposed schedule for the review
- Appendix A provides the decision rules for the classification system

2 Review of the KLS Landcover Anderson Level III map

This document outlines the review process for the KLCD01 map. The KLCD01 land cover map is an extension of the 16-class National Landcover Data Set 2001 (NLCD01) data set reviewed earlier by the review team. The NLCD01 will be used as the platform to which the KLCD01 map will be produced; a rigorous review process is required.

2.1 KLCD01 Classification Scheme

The classification scheme for the KLCD01 is based on a hierarchy, with rules assigned to each branch in the hierarchy. As one moves to successive branches in the hierarchy, the information about each class and complexity of the rules increases.

Major Classes - the first number represents the Anderson Level I (AL-I), second number Anderson Level II (AL-II), and third number Anderson Level III (AL-III). Classes to be identified in the USGS, NLCD01 are underlined. Other classes are specific to the KLS Project as part of the KLCD01.

1	Developed	
	11	<u>Developed Open Space</u>
	12	<u>Developed, Low Intensity</u>
	13	<u>Developed, Medium Intensity</u>
	14	<u>Developed, High Intensity</u>
2	Agriculture	
	21	<u>Cropland</u>
	22	<u>Pasture/Hay</u>
3	Openland	
	31	<u>Herbaceous</u>
	32	<u>Shrub</u>
	35	Openland Mined
4	Forest	
	41	<u>Deciduous Forest</u>
	411	<i>Oak Forest</i>
	412	<i>Yellow Poplar Forest</i>
	413	<i>Mixed Deciduous Forest</i>
	42	<u>Evergreen Forest</u>
	421	<i>Pine Forest</i>
	422	<i>Red Cedar Forest</i>
	423	<i>Hemlock Forest</i>
	424	<i>Mixed Evergreen</i>
	43	<u>Mixed Forest</u>
	431	<i>Oak –Pine Mixed Forest</i>
	432	<i>Other Mixed Forest</i>
	44	Woodland
	441	<i>Deciduous Woodland</i>
	442	<i>Coniferous Woodland</i>
	443	<i>Mixed Woodland</i>

5	Water	
		51 <u>Water</u>
6	Wetlands	
		61 <u>Lowland Forest</u>
		611 <i>Oak/Deciduous Floodplain Forest</i>
		612 <i>Riparian Forest</i>
		613 <i>Bald Cypress Wetland</i>
		614 <i>Floodplain Forest</i>
		615 <i>Woodland Wetland</i>
		616 <i>Black Willow Wetland</i>
		617 <i>Mixed Shrub Wetland</i>
		62 <u>Nonforested Wetlands</u>
		621 <i>Emergent Wetland</i>
		63 Mined Wetland
7	Barren	
		71 <u>Barren</u>
		72 Mined, bare

Italicized classes listed in this classification scheme are **AL-III** and not classified in the **AL-II NLCD01** land cover map. AL-III classes will be classified in the KLCD01.

3 QA/QC: The By – Area Review Process

3.1 Minimum Mapping Unit and Scale of Map

A key issue for reviewing the map is to understand the minimum mapping unit (MMU) concept used. The MMU is the smallest area mapped as a discrete unit. Selection of the MMU determines the extent of detail conveyed by an interpretation. The KLCD01 map has a MMU of 1.1 acres, or five (5) - 30 m Landsat pixels. This reduces the visual and spatial complexity of the information contained in the map and often increases the accuracy of the resultant map. A number of approaches can be used that reduce the salt and pepper appearance of classifications. The salt and pepper will be removed from the map by USGS using a process called “Smart Eliminate” the map being reviewed is the unfiltered map. Both products will be available after the final map has been produced.

The best scale for viewing the map is 1:50,000, this is a statewide map and should be viewed in this context. The map should show the patterns of land use across the State and errors in that should be identified. The map does not aim to capture information below the MMU, although sub-MMU variation is often seen in the classification. The focus of the review should be at this scale. Keeping in mind the 5 pixel MMU, each thematic class should be reviewed individually.

3.2 Recording Assessment

In previous review procedures, we have used other ancillary imagery and photo interpretation skills to qualify individual class accuracies. This methodology however becomes increasingly difficult when moving from a general level (AL-II) call to a community level (AL-III) call (for example, deciduous forest (AL-II) to an Oak Forest (AL-III)). Many classes can only be distinguished using on-the-ground field assessments. As ground verification is not generally an option for most reviewers, a more qualitative approach will be applied. Reviewers are asked to examine areas based on their a-priori knowledge or where existing spatial data of suitable quality can be used for comparison. A table has been provided for the review to qualify the overall quality of each class. The table provides for a standard assessment of Good, Medium, and Poor for each class. A class is qualified as “good” when a great majority (greater than 90%) of the pixels in the map is correctly classified. A class is considered “medium” when a majority of pixels (65% to 90%) in the map are correctly classified; however there is some confusion between similar land cover types. Finally, a class is determined to be “poor” when the class does not fit into the “good” and “medium” qualifications. Generally, a poor

classification has a slight number of or no majority of correctly classified pixels. In addition, a comment field is supplied. Reviewers are encouraged to submit detailed comments for each class.

The table should be filled out for each area examined by the reviewer, and a reference to the extent of the area must be associated with each table. Assessments as to the systematic misclassification or overall bias of a class are more helpful than the identification of specific pixels being misclassified.

Class Name	Class Number	Good	Medium	Poor	Comment
Developed Open Space	110				
Developed, Low Intensity	120				
Developed, Medium Intensity	130				
Developed, High Intensity	140				
Cropland	210				
Pasture/Hay	220				
Herbaceous	310				

Table 1: Quality assessment table for KLCD01 review

In addition to the completion of the quality assessment table for each review area, the reviews are required to complete a questionnaire as to the quality, usefulness, and potential or future use of the land cover data. The questionnaire will be made available via an online survey, available at <http://geo360-aa.com/Lists/KLCD%20Survey/overview.aspx>.

The following is an example of how a review may be completed using other available imagery. A comparison was made between the KLCD01 data and the newly available (National Agriculture Imagery Program) NAIP 1 meter aerial photography in Trigg County. Using this type of imagery, distinctions between deciduous forest types can not be made as they can not be distinguished in the NAIP imagery. However, separation of many of the wetland types and the lowland forest class through photo interpretation can be made in the NAIP imagery. The reviewer would assess classes they felt could be reasonably qualified and record the "good", "medium", or "poor" assessment. In addition, a comment should be filled in where the reviewer noticed an error with the KLCD01 map.

Finally the reviewer should record the area where the map was inspected by noting the center location in map coordinates, and the scale at which the map was viewed.



Figure 1: KLCD01 land cover data set (1:24000:700602, 1568941 ACEA* Nad83)

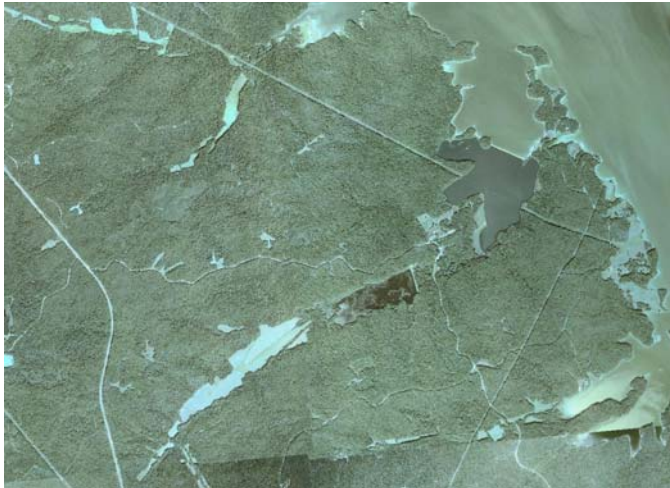


Figure 2: NAIP leaf on 1 meter imagery (1:24000:700602, 1568941 ACEA* Nad83)

* Albers Conic Equal Area

3.3 Provision of data to COT

The data sheets should be returned to DGI in digital form for ease of communication. If you have questions regarding this information please let Susan Lambert know by emailing her at susan.lambert@ky.gov or calling her at (502) 573-0342.

4 Schedule

The schedule for the review is given in the section below. We would like to meet this and will rely on both the KLS team and the reviewers to help us do this.

The KLCD01 product and ancillary data will be distributed to the reviewers in a viewable form using ESRI's Arc Reader software, which can be downloaded and installed on your computer. The KLCD01 data will be distributed on a DVD and the data can be incorporated into your own GIS or remote sensing software.

We are asking the reviewers to spend the next two weeks reviewing the map and provide comments to DGI that will be transmitted to Space Imaging. SI will review each comment provided in the specified format and produce a document that will discuss the issue raised and the steps taken to resolve these issues. This will be produced along side the final map. The map will also be reviewed by USGS Eros Data Center (EDC) before being posted to their website.

Dates are laid out below

1. Complete protocols for reviewers (This Document) **02/09/05**
 - a. Responsibility SI
2. Send notice to reviewers **02/10/05**
 - a. Responsibility COT
3. Mail Data to reviewers **02/14/05**
 - a. Responsibility COT
4. Review map and make comments send comments to COT **03/04/05**
 - a. Responsibility reviewers
5. Compile and assess comments and incorporate **03/15/05**
 - a. Responsibility SI
6. Complete coverage and response to comments **03/20/05**
 - a. Responsibility SI

5 Appendix A: Decision Rules for Level II Classification

Decision Rules for NLCD (USGS) classification

Major (Level 2) category decision rules

Classification system key for remote sensing and ground data gathering

If land area has > or = 75% open water then **Water**

Since no areas in KY are permanent snow/ice then **Water (510)**

Else if land area > or = 20% covered with areas characterized by impervious structures (e.g. Asphalt, concrete, buildings, etc.) then **Developed**

If land area > or = 80 % impervious then **Developed, High Intensity (140)**

Else if land area > or = 50% then **Developed, Medium Intensity (130)**

Else **Developed, Low Intensity (120)**

Else if the land area < 20% impervious surface and land is in a developed setting i.e. urban parks, lawns, golf courses, airport grasses and industrial sites grasses then **Developed, Open Space (110)**

Else if > 20% of the land area is vegetated and > 25% of the vegetation cover is characterized by herbaceous vegetation that has been planted or is intensely managed for the production of food, feed or fiber then **Agriculture**

If area is annually planted for crop production then **Cropland (210)** (includes orchards and vineyards)

Else **Pasture/Hay (220)**

Else if land area > or = 80% covered with bare rock, gravel, sand, silt, clay or other earthen materials then **Barren**

If Mined then **Mined Bare (720)**

Else **Barren (Rock/Sand/Clay) (710)**

Else if land area is periodically flooded or covered with water (defined by Cowardin *et al.*) and vegetation covers > 25% of land area then **Wetland**

If forest or shrubby (woody) vegetation > 25% of the vegetated cover then **Woody Wetland**

Else **Emergent Herbaceous Vegetation (620)**

Else if tree canopy (woody vegetation > 5 m tall) > 20% of land area and > 25% of vegetation then **Forest**

If deciduous tree canopy > or = 75% then **Deciduous Forest**

Else if evergreen tree canopy > or = 75% then **Evergreen Forest**

Else **Upland Mixed Forest**

Else if woody vegetation (< 6 m tall) > 20% of land area and > 50% of vegetation then **Shrubland**

Else **Short Shrub (320)**

Else if herbaceous vegetation > 20% of land area and > 75% of vegetation then **Grassland**

Herbaceous (310)

End

Subdivision for forest wetlands and open land classes for KLS project

Key for the classification of forest types

Species names have been abbreviated, with subscripts indicating species, where no subscript is indicated it means that all species are included in the calculation.

Species Codes

As	Ash
Ba	Basswood
Be	Beech
Bi	Birch
Ce _r	Red Cedar
Co	Cottonwood
Cy	Bald Cypress
H	Eastern Hemlock
M	Maple
O	Oak
P	Pine
Po	Yellow Poplar
Sy	Sycamore
T	Tupelo (Water)
W _b	Black Willow

Other species have been given their full name

Key

Else if land area is periodically flooded or covered with water (defined by Cowardin *et al.*) and vegetation covers > 25% of land area then **Wetland**

 If forest or shrubby (woody) vegetation > 25% of land area then **Woody Wetland**

 If tree canopy > 60% of the vegetation then **Forested Wetland**

 If O > 60% of tree canopy then **Oak/Deciduous Floodplain Forest (611)**

 Else if (M + Bi + Sy + Co + W_b) > 60% of tree Canopy and adjacent to water then **Riparian Forest (612)**

 Else if (Cy + T) > 60% of tree canopy then **Bald Cypress Wetland (613)**

 Else **Floodplain Forest (614)**

 Elseif tree canopy > 25% of land area then **Woodland Wetland (615)**

 Else **Shrub Wetland**

 If W_b > 60% of woody cover then **Black Willow Wetland (616)**

 Else **Mixed Shrub Wetland (617)**

 Else **Emergent Herbaceous Vegetation**

Emergent Wetland (620)

Else if tree canopy (woody vegetation > 5 m tall) > 20% of land area and > 25% of vegetation then **Forest**

 If tree canopy < 60% of land area then **Woodland**

 If deciduous tree canopy > 75% of tree canopy then **Deciduous Woodland (441)**

 Else if coniferous tree canopy > 75% of tree canopy then **Coniferous Woodland (442)**

 Else **Mixed Woodland (443)**

Else if **Deciduous Forest**

If tree canopy > 60% O then **Oak Forest** (*includes dry oak and dry-mesic oak*) **(411)**

Else if tree canopy > 60% Po then **Yellow Poplar Forest (412)**

Else **Mixed Deciduous Forest (413)**

Else if **Evergreen Forest**

If tree canopy > 60% H then **Hemlock Forest (423)**

Else if tree canopy > 60% Ce_r then **Red Cedar Forest (422)**

Else **Pine Forest (421)**

Else **Mixed Forest**

If tree canopy > 60% (O + P) then **Oak – Pine Mixed Forest (431)**

Else if H > 25% then **Hemlock – Mixed Deciduous Forest (432)**

Else **Other Mixed Forest** (*includes Red Cedar-Oak*) **(433)**

Else if herbaceous vegetation > 20% of land area and > 75% of vegetation then **Grassland**

If mined **Mined, Herbaceous (350)**

Herbaceous (310)

Notes:

- i. Topographic variations related to specific positions on the landscape related to altitude or aspect can also be modeled out using spectral and ancillary data, such as distance from rivers etc.
- ii. Young regeneration of forest will be defined as shrubland under the current classification system. It is thought that after harvest it will take between 3 – 5 years for the forestland to reach full canopy closure and a height of 5 m, to meet the definition of forest. It is understood that in Kentucky this is a transitional class and interpretation of the map should be made accordingly. I.e. if an area of shrubland occurs within a forest area it is likely to be young regenerating forest.